

CLAIMS

We claim:

- 1 1. A battery safety monitor system, comprising:
 - 2 a) at least one battery comprising at least one cell string , wherein said at least one cell
 - 3 string is capable of outputting voltage signals;
 - 4 b) at least one zener diode, operatively coupled to said at least one battery cell string,
 - 5 capable of receiving and reducing voltage signals, and capable of outputting voltage
 - 6 signals;
 - 7 c) at least one safety device, operatively coupled to said at least one battery cell string,
 - 8 capable of preventing damage to said at least one battery cell string;
 - 9 d) a microcontroller, operatively coupled to said at least one zener diode, capable of
 - 10 receiving and outputting data;
 - 11 e) a display device, operatively coupled to said microcontroller, capable of receiving data,
 - 12 and capable of displaying at least one battery voltage level;
 - 13 f) a power supply, operatively coupled to said microcontroller and said display device,
 - 14 capable of supplying power to said microcontroller and said display device.
- 1 2. The battery safety monitor system of Claim 1, wherein said safety device is selected from the
- 2 group consisting of PTC, thermal fuse, fuse, isolation diode, wetness detector and
- 3 optoisolator.
- 1 3. The battery safety monitor system of Claim 1, wherein said display device is selected from
- 2 the group consisting of visual alarms, audible alarms, relay switches and serial interfaces
- 3 coupled to display computers.
- 1 4. The battery safety monitor system of Claim 1, wherein said at least one battery comprises a
- 2 plurality of batteries, wherein said battery safety monitor system further comprises an analog
- 3 multiplexer, operatively coupled to said plurality of batteries and said at least one zener
- 4 diode, capable of selectively receiving voltage signals from one of said plurality of batteries.

- 1 5. The battery safety monitor system of Claim 1, wherein said battery safety monitor system
2 further comprises an A/D converter, operatively coupled to said at least one zener diode and
3 said microcontroller, capable of converting voltage signals to digital signals, and capable of
4 outputting digital signals to said microcontroller, and capable of receiving control signals
5 from said microcontroller.
6. The battery safety monitor system of Claim 1, wherein said battery safety monitor system
further comprises an optoisolator, operatively coupled to said microcontroller, said power
supply and said at least one display device, capable of preventing reverse currents, and
capable of receiving and transmitting digital signals, and capable of receiving power from
10 said power supply.
- 1 7. A battery safety monitor system, comprising:
- 2 a) at least one string unit, comprising:
- 3 i) at least one battery cell string capable of outputting voltage signals;
- 4 ii) at least one safety device, operatively coupled to said at least one battery cell string,
5 capable of preventing damage to said at least one battery cell string;
- 6 b) at least one battery monitor, operatively coupled to said at least one string unit,
7 comprising:
- 8 i) at least one zener diode capable of receiving and reducing voltage signals, and
9 capable of outputting voltage signals;
- 10 ii) a first microcontroller, operatively coupled to said at least one zener diode, capable of
11 receiving and outputting data;
- 12 c) a data collection and display device, operatively coupled to said at least one battery
13 monitor, comprising:
- 14 i) a display device capable of receiving data, and capable of displaying at least one
15 battery voltage level;
- 16 ii) a power supply, operatively coupled to said battery monitor and said display device,
17 capable of supplying power to said battery monitor and said display device.

1 8. The battery safety monitor system of Claim 7, wherein said at least one battery monitor
2 further comprises:

3 iii) an analog MUX, operatively coupled to said at least one string unit and said at least one
4 zener diode, capable of selectively receiving voltage signals from one of said at least one
5 string unit, and capable of outputting voltage signals to said at least one zener diode.

6 iv) an A/D converter, operatively coupled to said at least one zener diode and said first
7 microcontroller, capable of converting voltage signals to digital signals, and capable of
8 outputting digital signals to said first microcontroller, and capable of receiving control
9 signals from said first microcontroller

10 v) an optoisolator, operatively coupled to said first microcontroller and said data collection
11 and display device, wherein said optoisolator is capable of preventing reverse currents, and
12 capable of receiving and transmitting digital signals, and capable of receiving power from
13 said power supply.

1 9. The battery safety monitor system of Claim 8, wherein said optoisolator further comprises:

2 (1) a serial interface, operatively coupled to said microcontroller and said
3 optoisolator, capable of receiving and outputting digital signals;

4 (2) a connector, operatively coupled to said optoisolator and said data collection and
5 display device, capable of receiving and outputting digital signals, and capable of
6 receiving and outputting power.

1 10. The battery safety monitor system of Claim 9, wherein said serial interface comprises a
2 UART.

1 11. The battery safety monitor system of Claim 9, wherein said connector comprises long wires.

1 12. The battery safety monitor system of Claim 8, wherein said at least one battery monitor
2 further comprises a wetness detector, operatively coupled to said A/D converter, wherein said
3 wetness detector is capable of detecting dangerous battery conditions.

- 1 13. The battery safety monitor system of Claim 7, wherein said data collection and display
2 device further comprises:
- 3 iii) a second microcontroller, operatively coupled to said at least one display device and said
4 power supply, capable of transmitting control signals, and capable of receiving and
5 outputting power.
- 6 iv) a digital MUX, operatively coupled to said at least one battery monitor, said second
7 microcontroller and said at least one power supply, capable of selectively receiving digital
8 signals from one of said at least one battery monitor, and capable of receiving control signals
9 from said second microcontroller, and capable of receiving power from said power supply,
10 and capable of outputting digital signals.
- 1 14. A method for a battery safety monitor system, the method comprising the steps of:
- 2 a) measuring string voltage using said battery safety monitor system;
- 3 b) determining whether string voltage dropped a predetermined amount since last
4 measurement;
- 5 c) displaying an alert if string voltage dropped said predetermined amount and proceeding
6 to STEP (h);
- 7 d) determining whether string voltage is below a safe threshold;
- 8 e) displaying an alert if string voltage is below said safe threshold and proceeding to STEP
9 (h);
- 10 f) determining whether wetness is detected;
- 11 g) displaying an alert if wetness is detected and proceeding to STEP (h);
- 12 h) displaying a status of at least one battery;
- 13 i) returning to STEP (a).